Chapter A2: Need for the Regulation

INTRODUCTION

CHAPTER CONTENTS

Section 316(b) of the Clean Water Act (CWA) directs EPA to assure that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available (BTA) for minimizing adverse environmental impact (AEI). Based on this statutory language, section 316(b) is already in effect and should be implemented with each NPDES permit issued to a directly discharging facility. However, no national standard for BTA that will minimize AEI from cooling water intake structures (CWIS) has been established to date. As a result, many CWIS have been constructed on sensitive aquatic systems with capacities and designs that cause damage to the waterbodies from which they withdraw water. In addition, the absence of regulations that establish standards for BTA has led to an inconsistent application of section 316(b). In fact, only 145 out of 550 facilities with flows greater than 50 million gallons per day (MGD) have indicated on EPA's 2000 Section 316(b) Industry Survey that they have ever performed a section 316(b) study (U.S. EPA, 2000).

This chapter provides a brief overview of the facilities subject to this rule and their use of cooling water, and presents the need for this regulation.

A2-1 OVERVIEW OF REGULATED FACILITIES

The Proposed Section 316(b) Phase II Existing Facilities Rule applies to existing power producing facilities with a design intake flow of 50 MGD or greater. The Phase II rule also covers substantial additions or modifications to operations undertaken at such facilities. The proposed Phase II rule does not cover (1) new steam electric power generating facilities, (2) new manufacturing facilities, (3) existing steam electric power generating facilities with a design intake flow of less than 50 MGD, and (4) existing manufacturing facilities.[1]

The remainder of this section describes the industry sectors subject to the Phase II rule and the existing utility and nonutility steam electric power generating facilities analyzed for this regulatory effort. *Chapter A3: Profile of the Electric Power Industry* and *Chapter B3: Electricity Market Model Analysis* of this Economic and Benefits Analysis (EBA) present more detailed information on the facilities subject to the Phase II rule and the market in which they operate.

A2-1.1 Phase II Sector Information

Past section 316(b) regulatory efforts and EPA's effluent guidelines program identified steam electric generators as the largest industrial users of cooling water. The condensers that support the steam turbines in these facilities require substantial amounts of cooling water. EPA estimates that steam electric utility power producers (SIC Codes 4911 and 4931) and steam electric nonutility power producers (SIC Major Group 49) account for approximately 92.5 percent of total cooling water

[1] New facilities were covered under the final section 316(b) New Facility Rule (Phase I), which EPA promulgated in November 2001. Existing steam electric power generating facilities with a design intake flow of less than 50 MGD and existing manufacturing facilities will be addressed by a separate rule.

intake in the United States (U.S. EPA, 2001). Beyond steam electric generators, other industrial facilities use cooling water in their production processes (e.g., to cool equipment, for heat quenching, etc.).

EPA's 2000 Section 316(b) Industry Survey collected cooling water information for 676 power producers and 396 other industrial facilities. These facilities withdraw 216 and 26.5 billion gallons per day (BGD) of cooling water, respectively. Of the power producers, 539 meet the "in-scope" requirements of this proposed rule. These 539 facilities represent 550 facilities in the industry.[2] Based on the survey, the 550 Phase II facilities account for approximately 216 BGD, or 96.3 percent of all estimated power producers. Industrial categories other than power producers are not covered by this proposed Phase II rule.

Table A2-1 summarizes cooling water use information of steam electric power generating facilities and major industrial categories.

Table A2-1: Estimated Cooling Water Intake by Sector - EPA Survey

Sector[a]	Estimated Number of Facilities	Total Cooling Water Intake Average Flow	Cooling Water Intake Average Flow Subject to Phase II Rule	
		Billion Gal./Yr.	Billion Gal./Yr.	Percent of Total Steam Electric and Industrial
Steam Electric Power Producers	708	81,753	78,703	82.4%
Steam Electric Utility Power Producers	*591*	*72,665*	*71,471*	*74.8%*
Steam Electric Nonutility Power Producers	*117*	*9,088*	*7,232*	*7.6%*
Major Industrial Categories[b]	773	13,752	0	0.0%
Total Steam Electric and Industrial	1,481	95,505	78,703	82.4%

[a] Estimates for each sector are based on facility categorization at the time of the survey; some utility facilities have since been sold to non-utilities.

[b] Major industrial categories (major SIC codes) surveyed with EPA questionnaires: Paper and Allied Products (SIC Major Group 26), (2) Chemicals and Allied Products (SIC Major Group 28), (3) Petroleum and Coal Products (SIC Major Group 29), and (4) Primary Metals Industries (SIC Major Group 33).

Source: U.S. EPA, 2000.

A2-1.2 Phase II Facility Information

The 550 steam electric power generating facilities subject to the proposed Phase II rule comprise a substantial portion of the U.S. electric power market. As shown in Table A2-2, the 550 facilities represent 13 percent of all facilities in the U.S. electric power market. In 2008, the Phase II facilities are projected to have a generating capacity of 416,000 MW (48 percent of total), generate 2.3 billion MWh of electricity (56 percent of total), and realize $75 billion in revenues (49 percent of total).

[2] EPA applied sample weights to the 539 facilities to account for non-sampled facilities and facilities that did not respond to the survey. For more information on EPA's 2000 Section 316(b) Industry Survey, please refer to the Information Collection Request (U.S. EPA, 2000).

Table A2-2: Summary Economic Data for Electricity Market and Phase II Facilities

Economic Measure	Industry Total[a]	Facilities Subject to Phase II Rule[b]	
		Phase II Total	% of Industry Total
Number of Facilities	4,091	550	13%
Electric Generating Capacity (MW)	875,000	416,000	48%
Net Generation (million MWh)	4,100	2,300	56%
Revenues (in billions, $2001)	$152	$75	49%

[a] Industry Totals are based on ICF Consulting's Integrated Planning Model (IPM®), section 316(b) base case, 2008. The IPM models 4,091 unique facilities. Industrial boilers are not modeled by the IPM. For a discussion of EPA's use of the IPM in support of this proposed rule, see *Chapter B3: Electricity Market Model Analysis*.

[b] The IPM models 540 of the 550 Phase II facilities. Eleven of the 540 facilities are closures in the section 316(b) base case run for 2008. The Phase II totals for capacity, generation, and revenues include the activities of the 529 in-scope facilities that are modeled by the IPM and are not closures in the base case.

Source: IPM analysis: model run for Section 316(b) base case, 2008.

Most of the analyses of economic impacts and energy effects presented in this Economic and Benefits Analysis present results by geographic region (i.e., North American Electric Reliability Council, or "NERC," region). Analyzing results by geographic region is of interest because regional concentrations of compliance costs could adversely impact electric power system reliability and prices, if a large percentage of overall capacity is affected. Some analyses are also presented by plant type. Analyzing results by plant type is of interest because a regulation that has disproportionate effects on particular types of facilities could lead to shifts in technology selection, if the effects are substantial enough.

Table A2-3 presents the distribution of facilities subject to the Phase II rule by NERC region and plant type. The table shows that the majority of facilities subject to the Phase II rule, 299, or 54.5 percent, are coal-fired steam-electric facilities. The other major plant types are oil- or gas-fired steam-electric facilities (169, or 30.8 percent) and nuclear facilities (57, or 10.4 percent). The remaining 4.4 percent are combined-cycle or other steam facilities. On a regional level, the East Central Area Reliability Council (ECAR) and the Southeastern Electric Reliability Council (SERC) account for the highest numbers of Phase II facilities with 100 (18.3 percent) and 95 (17.3 percent), respectively.

Table A2-3: Distribution of Phase II Facilities by NERC Region and Plant Type

NERC Region[a]	Coal	Combined Cycle	Nuclear	Oil/Gas	Other Steam	Total	Percent of Phase II
ASCC	1	0	0	0	0	**1**	**0.2%**
ECAR	91	0	6	3	0	**100**	**18.3%**
ERCOT[b]	9	1	2	39	0	**51**	**9.3%**
FRCC	7	5	1	17	0	**30**	**5.5%**
HI	0	0	0	3	0	**3**	**0.5%**
MAAC	17	2	7	15	2	**44**	**8.0%**
MAIN	41	0	8	2	0	**51**	**9.3%**
MAPP	34	0	4	6	0	**44**	**8.1%**
NPCC	17	4	9	28	5	**62**	**11.4%**
SERC	55	1	17	22	0	**95**	**17.3%**
SPP	19	0	1	12	0	**32**	**5.8%**
WSCC	7	3	2	21	1	**34**	**6.3%**
Total	**299**	**16**	**57**	**169**	**8**	**549**	
Percent of Phase II	**54.5%**	**2.9%**	**10.4%**	**30.8%**	**1.5%**		

[a] **Key to NERC regions:** ASCC – Alaska Systems Coordinating Council; ECAR – East Central Area Reliability Coordination Agreement; ERCOT – Electric Reliability Council of Texas; FRCC – Florida Reliability Coordinating Council; HI – Hawaii; MAAC – Mid-Atlantic Area Council; MAIN – Mid-America Interconnect Network; MAPP – Mid-Continent Area Power Pool; NPCC – Northeast Power Coordinating Council; SERC – Southeastern Electric Reliability Council; SPP – Southwest Power Pool; WSCC – Western Systems Coordinating Council.

[b] The plant type for one facility in ERCOT was not available. The total number of Phase II facilities presented in this table therefore is 549, not 550.

Source: U.S. DOE 1999a; U.S. DOE 1999b

A2-2 THE NEED FOR SECTION 316(B) REGULATION

The withdrawal of cooling water removes trillions of aquatic organisms from waters of the U.S. each year, including plankton (small aquatic animals, including fish eggs and larvae), fish, crustaceans, shellfish, sea turtles, marine mammals, and many other forms of aquatic life. Most impacts are to early life stages of fish and shellfish.

Aquatic organisms drawn into CWIS are either impinged on components of the intake structure or entrained in the cooling water system itself. Impingement takes place when organisms are trapped on the outer part of an intake structure or against a screening device during periods of intake water withdrawal. Impingement is caused primarily by hydraulic forces in the intake stream. Impingement can result in (1) starvation and exhaustion; (2) asphyxiation when the fish are forced against a screen by velocity forces that prevent proper gill movement or when organisms are removed from the water for prolonged periods; (3) descaling and abrasion by screen wash spray and other forms of physical damage.

Entrainment occurs when organisms are drawn into the intake water flow entering and passing through a CWIS and into a cooling water system. Organisms that become entrained are those organisms that are small enough to pass through the intake screens, primarily eggs and larval stages of fish and shellfish. As entrained organisms pass through a plant's cooling water system, they are subject to mechanical, thermal, and or toxic stress. Sources of such stress include physical impacts in the pumps and condenser tubing, pressure changes caused by diversion of the cooling water into the plant or by the hydraulic effects of the condensers, sheer stress, thermal shock in the condenser and discharge tunnel, and chemical toxemia induced by antifouling agents such as chlorine.

Rates of impingement and entrainment (I&E) depend on species characteristics, the environmental setting in which a facility is located, and the location, design, and capacity of the facility's CWIS. Species that spawn in nearshore areas, have planktonic eggs and larvae, and are small as adults experience the greatest impacts, since both new recruits and reproducing adults are affected (e.g., bay anchovy in estuaries and oceans). In general, higher I&E is observed in estuaries and near coastal waters because of the presence of spawning and nursery areas. By contrast the young of freshwater species are generally epibenthic and/or hatch from attached egg masses rather than existing as free-floating individuals, and therefore freshwater species may be less susceptible to entrainment.

The likelihood of I&E also depends on facility characteristics. If the quantity of water withdrawn is large relative to the flow of the source waterbody, a larger number of organisms will be affected. Intakes located in nearshore areas tend to have greater ecological impacts than intakes located offshore, since nearshore areas are usually more biologically productive and have higher concentrations of aquatic organisms (see the Pilgrim-Seabrook comparison in *Part G: New England Ocean* of the *Case Study Analysis for the Proposed Section 316(b) Phase II Existing Facilities Rule*. EPA estimates that CWIS used by the 550 facilities subject to the proposed rule impinge and entrain billions of age 1 equivalent fish annually (see Table C2-10 in *Chapter C2: Summary of Case Study Results* of this EBA for further detail).

In addition to direct losses of aquatic organisms from I&E, there are a number of indirect, ecosystem-level effects that may occur, including (1) disruption of aquatic food webs resulting from the loss of impinged and entrained organisms that provide food for other species, (2) disruption of nutrient cycling and other biochemical processes, (3) alteration of species composition and overall levels of biodiversity, and (4) degradation of the overall aquatic environment. In addition to the impacts of a single CWIS on currents and other local habitat features, environmental degradation can result from the cumulative impact of multiple intake structures operating in the same watershed or intakes located within an area where intake effects interact with other environmental stressors.

Several factors drive the need for this final section 316(b) rule. Each of these factors is discussed in the following sections.

A2-2.1 Low Levels of Protection at Phase II Facilities

Facilities in the power producing industry use a wide variety of cooling water intake technologies to maximize cooling system efficiency, minimize damage to their operating systems, and to reduce environmental impacts. The following subsections present data on technologies that have been identified as effective in protecting aquatic organisms from I&E. EPA used information from its 2000 Section 316(b) Industry Survey to characterize the 550 in-scope Phase II facilities with respect to these technologies. Based on this information, EPA believes that many facilities subject to this proposed rule are not using BTA to minimize AEI.

a. Closed-cycle cooling systems

Closed-cycle cooling systems (e.g., systems employing cooling towers) are the most effective means of protecting organisms from I&E. Cooling towers reduce the number of organisms that come into contact with a CWIS because of the significant reduction in the volume of intake water needed by a closed-cycle facilities. Reduced water intake results in a significant reduction in damaged and killed organisms. Of the 550 in-scope Phase II facilities, 73 (13 percent) reported the use of closed-cycle cooling systems.

Table A2-4: Estimated Number of Facilities by CWS Configuration and CWIS Technology (Design Flow >= 50 MGD)

CWIS Technology	CWS Configuration							
	Once Through		Recirculating		Combination		None/unknown	
	#	%	#	%	#	%	#	%
Intake screening technologies	26	6.3%	0	0.0%	5	10.0%	0	0.0%
Passive intake systems	42	10.1%	13	17.8%	9	18.0%	1	9.1%
Fish diversion or avoidance systems	17	4.1%	2	2.7%	2	4.0%	0	0.0%
Fish handling or return technologies	53	12.7%	3	4.1%	7	14.0%	2	18.2%
Other/none/unknown	213	51.2%	46	63.0%	20	40.0%	7	63.6%
Combination of technologies	65	15.6%	9	12.3%	7	14.0%	1	9.1%
Total	**416**	**100.0%**	**73**	**100.0%**	**50**	**100.0%**	**11**	**100.0%**

Source: U.S. EPA, 2000.

b. Other CWIS technologies

Discussions with NPDES permitting authorities and utility officials identified fine mesh screens as an effective technology for minimizing entrainment. They can, however, increase impingement. Data from the questionnaires indicate that of the 550 in-scope Phase II facilities, seven (one percent) employed fine mesh screens on at least one CWIS. These seven plants represented less than one percent of the cooling water withdrawn from surface waters by plants reporting data. These findings indicate that, in general, BTA is not being used and further regulation is required.

Table A2-5: Estimated Number of Facilities by CWIS Technology (Design Flow >= 50 MGD)

CWIS Technology	Number of Facilities	Percent of Total
Intake screening technologies	31	5.6%
Passive intake systems	65	11.8%
Fish diversion or avoidance systems	21	3.8%
Fish handling or return technologies	65	11.8%
Other/none/unknown technology	286	52.0%
Combination of technologies	82	14.9%
Total	**550**	**100.0%**

Source: U.S. EPA, 2000.

c. Cooling system location

Another effective approach for minimizing AEI associated with CWIS is to locate the intake structures in areas with low abundance of aquatic life and design the structures so that they do not provide attractive habitat for aquatic communities. However, this approach is of little utility for existing facilities where options for relocating intake structures are infeasible.

Table A2-6 shows the estimated number of facilities by the source of water from which cooling water is withdrawn. The table indicates that 135 steam electric power generation facilities are located on estuaries, tidal rivers, or oceans that are considered to be areas of high productivity and abundance. In addition, estuaries are often nursery areas for many species. The flow to these facilities totaled 32 percent of the total cooling water being withdrawn by all in-scope Phase II facilities. However, the remaining 415 facilities (68 percent of flow) were reported as being located on fresh waterbodies (including Great Lakes).

Table A2-6: Estimated Number of Facilities by Source of Surface Water (Design Flow >= 50 MGD)

Source of Surface Water	Number of Facilities	Percent of Total
Estuary/Tidal river	112	20.4%
Freshwater stream/River	263	47.8%
Great Lake	16	2.9%
Lake/Reservoir	135	24.6%
Ocean	23	4.3%
Total[a]	**550**	**100.0%**

[a] Individual numbers may not add up due to independent rounding.

Source: U.S. EPA, 2000.

A2-2.2 Reducing Adverse Environmental Impacts

Adverse environmental impacts occur when facilities impinge aquatic organisms on the screens of their CWIS, entrain them within their cooling system, or otherwise negatively affect habitats that support aquatic species. Exposure of aquatic organisms to I&E depends on the location, design, construction, capacity, and operation of a facility's CWIS (U.S. EPA, 1976; SAIC, 1994; SAIC, 1996). The regulatory goals of section 316(b) include the following:

- ensure that the location, design, construction, and capacity of a facility's CWIS reflect best technology available for minimizing adverse environmental impact;
- protect individuals, populations, and communities of aquatic organisms from harm (reduced viability or increased mortality) due to the physical and chemical stresses of I&E; and
- protect aquatic organisms and habitat that are indirectly affected by CWIS because of trophic interactions with species that are impinged or entrained.

Impingement occurs when fish are trapped against intake screens by the velocity of the intake flow. Organisms may die or be injured as a result of:

- starvation and exhaustion,
- asphyxiation when velocity forces prevent proper gill movement,
- abrasion by screen wash spray,
- asphyxiation due to removal from water for prolonged periods, and
- removal from the system by means other than returning them to their natural environment.

Small organisms are entrained when they pass through a plant's condenser cooling system. Injury and death can result from the following:

- physical impacts from pump and condenser tubing,
- pressure changes caused by diversion of cooling water,
- thermal shock experienced in condenser and discharge tunnels, and

- chemical toxemia induced by the addition of anti-fouling agents such as chlorine.

Mortality of entrained organisms is usually extremely high.

Review of the available literature and section 316(b) demonstration studies has identified numerous documented cases of impacts associated with I&E and the effects of I&E on individual organisms and on populations of aquatic organisms. For example, specific losses attributed to individual steam electric generating plants include annual losses of 3 to 4 billion larvae, equivalent to 23 million adult fish and shellfish,[3] 23 tons of fish and shellfish of recreational, commercial, or forage value lost each year,[4] and 1 million fish lost during a three-week study period.[5] The yearly loss of billions of individuals is not the only problem. Often, there are impacts to populations as well. For example, studies of Hudson River fish populations predicted reductions of up to 20 percent for striped bass, 25 percent for bay anchovy, and 43 percent for Atlantic tom cod, even without assuming 100 percent mortality of entrained organisms.[6] Estimates of lost midwater fish species due to direct entrainment by CWIS at the San Onofre Nuclear Generating Station (SONGS) are between 16.5 to 45 tons per year.[7] This loss represents a 41 percent mortality rate for fish (primarily northern anchovy, queenfish, and white croaker) entrained by intake water at SONGS. In a normal year, approximately 350,000 juvenile white croaker are estimated to be killed through entrainment at SONGS. This number represents 33,000 adult individuals or 3.5 tons of adult fish. Changes in densities of fish populations within the vicinity of the plant, relative to control populations, were observed in species of queen fish and white croaker. The density of queenfish and white croaker within three kilometers of SONGS decreased by 34 to 63 percent in shallow water samples and 50 to 70 percent in deep water samples.

The main purpose of this regulation is to minimize losses such as those described above. See *Part C: National Benefits* and *Part D: Benefit-Cost Analysis* of this EBA for information on the ability of the different options to reduce impingement and entrainment. See also the *Case Study Analysis for the Proposed Section 316(b) Phase II Existing Facilities Rule* for detailed information on baseline losses at case study facilities.

A2-2.3 Addressing Market Imperfections

The conceptual basis of environmental legislation in general, and the Clean Water Act and the section 316(b) regulation in particular, is the need to correct imperfections in the markets that arise from uncompensated environmental externalities. Facilities withdraw cooling water from a water of the U.S. to support electricity generation, steam generation, manufacturing, and other business activities, and, in the process impinge and entrain organisms without accounting for the consequences of these actions on the ecosystem or other parties who do not directly participate in the business transactions. The actions of these section 316(b) facilities impose environmental harm or costs on the environment and on other parties (sometimes referred to as *third parties*). These costs, however, are not recognized by the responsible entities in the conventional market-based accounting framework. Because the responsible entities do not account for these costs to the ecosystem and society, they are *external* to the market framework and the consequent production and pricing decisions of the responsible entities. In addition, because no party is compensated for the adverse consequences of I&E, the externality is *uncompensated*.

Business decisions will yield a less than optimal allocation of economic resources to production activities, and, as a result, a less than optimal mix and quantity of goods and services, when external costs are not accounted for in the production and pricing decisions of the section 316(b) industries. In particular, the quantity of AEI caused by the business activities of the responsible business entities will exceed optimal levels and society will not maximize total possible welfare. Adverse distributional effects may be an additional effect of the uncompensated environmental externalities. If the distribution of I&E and ensuing AEI is not random among the U.S. population but instead is concentrated among certain population subgroups

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[3] Brunswick Nuclear Steam Electric Generating Plant (U.S. EPA, Region IV, 1979).

[4] Crystal River Power Plant (U.S. EPA, Region IV, 1986).

[5] D.C. Cook Nuclear Power Plant (Thurber, 1985).

[6] Bowline Point, Indian Point 2 & 3, and Roseton Steam Electric Generating Stations (ConEd, 2000).

[7] San Onofre Nuclear Generating station (SAIC, 1993)

based on socio-economic or other demographic characteristics, then the uncompensated environmental externalities may produce undesirable transfers of economic welfare among subgroups of the population.

The goal of environmental legislation and subsequent implementing actions, such as the section 316(b) regulation that is the subject of this analysis, is to correct environmental externalities by requiring the responsible parties to reduce their actions causing environmental damage. Congress, in enacting the authorizing legislation, and EPA, in promulgating the implementing regulations, act on behalf of society to minimize environmental impacts (i.e., achieve a lower level of I&E and associated environmental harm). These actions result in a supply of goods and services that more nearly approximates the mix and level of goods and services that would occur if the industries impinging and entraining organisms fully accounted for the costs of their AEI-generating activities.

Requiring facilities to minimize their environmental impacts by reducing levels of I&E (i.e., reducing environmental harm) is one approach to addressing the problem of environmental externalities. This approach internalizes the external costs by turning the societal cost of environmental harm into a direct business cost – the cost of achieving compliance with the regulation – for the impinging and entraining entities. A facility causing AEI will either incur the costs of minimizing its environmental impacts, or will determine that compliance is not in its best financial interest and will cease the AEI-generating activities.

It is theoretically possible to correct the market imperfection by means other than direct regulation. Negotiation and/or litigation, for example, could achieve an optimal allocation of economic resources and mix of production activities within the economy. However, the transaction costs of assembling the affected parties and involving them in the negotiation/litigation process as well as the public goods character of the improvement sought by negotiation or litigation will frequently render this approach to addressing the market imperfection impractical. Although the environmental impacts associated with CWIS have been documented since the first attempt at section 316(b) regulation in the late 1970s, implementation of section 316(b) to date has failed to address the market imperfections associated with CWIS effectively.

A2-2.4 Reducing Differences Between the States

NPDES permitting authorities have implemented the requirements of section 316(b) in widely varying ways. The language used in the statutes or regulations vary from state to state almost as much as the interpretation. Most states do not address section 316(b) at all.

Table A2-7. below illustrates a variety of ways in which states identify the section 316(b) requirements.

Table.A2-7: Selected NPDES State Statutory/Regulatory Provisions Addressing Impacts from Cooling Water Intake Structures

NPDES State	Citation	Summary of Requirements
Connecticut	RCSA § 22a, 430-4	Provides for coordination with other Federal/State agencies with jurisdiction over fish, wildlife, or public health, which may recommend conditions necessary to avoid substantial impairment of fish, shellfish, or wildlife resources
New Jersey	NJAC § 7:14A-11.6	Criteria applicable to intake structure shall be as set forth in 40 *CFR* Part 125, when EPA adopts these criteria
New York	6 NYCRR § 704.5	The location, design, construction, and capacity of intake structures in connection with point source thermal discharges shall reflect BTA for minimizing environmental impact
Maryland	MRC § 26.08.03	Detailed regulatory provisions addressing BTA determinations
Illinois	35 Ill. Admin. Code 306.201 (1998)	Requirement that new intake structures on waters designated for general use shall be so designed as to minimize harm to fish and other aquatic organisms
Iowa	567 IAC 62.4(455B)	Incorporates 40 CFR part 401, with cooling water intake structure provisions designated "reserved"
California	Cal. Wat. Code § 13142.5(b)	Requirements that new or expanded coastal power plants or other industrial installations using seawater for cooling shall use best available site, design technology, and mitigation measures feasible to minimize intake and mortality of marine life

Source: SAIC, 1994b.

Additionally, in discussions with state and EPA regional contacts, EPA has found that states differ in the manner in which they implement their section 316(b) authority. Some states and regions review section 316(b) requirements each time an NPDES permit is reissued. These permitting authorities may reevaluate the potential for impacts and/or the environment that influences the potential for impacts at the facility. Other permitting authorities made initial determinations for facilities in the 1970s but have not revisited the determinations since.

Based on the above findings, EPA believes that approaches to implementing section 316(b) vary greatly. It is evident that some authorities have regulations and other program mechanisms in place to ensure continued implementation of section 316(b) and evaluation of potential impacts from CWIS, while others do not. Furthermore, there appears to be no mechanism to ensure consistency across all states. Section 316(b) determinations are currently made on a case-by-case basis, based on permit writers' best professional judgment. Through discussions with some state permitting officials (e.g., in California, Georgia, and New Jersey), EPA was asked to establish national standards in order to help ease the case-by-case burden on permit writers and to promote national uniformity with respect to implementation of section 316(b).

When environmental policies are implemented differently by two or more states that share access to the same waterbody, a conflict may occur between the states because environmental losses caused in one state may affect the biology, environmental conditions, and benefits of another state. Differences of this type are most likely to occur when the regulations governing the operation of CWIS are established at the state level or are implemented in fundamentally different ways by the states (i.e., more and less stringent due to policy or failure to implement). When this happens, the state with less stringent requirements imposes "external costs" or damages on the other state.

A good example of a conflict between states is in Mount Hope Bay, an interstate water straddling the Massachusetts/Rhode Island state line. Brayton Point Station in Somerset, Massachusetts is the largest fossil fuel-burning steam-electric generating facility in New England. The facility may have caused or contributed to a documented collapse in fish populations in Mount Hope Bay affecting Rhode Island as well as Massachusetts.

The plant uses a once-through-cooling water system and is allowed by its current NPDES permit to withdraw up to 1.452 billion gallons a day (BGD) of water from Mount Hope Bay for cooling and then to discharge the heated water back to the Bay at temperatures up to 22^0F above ambient water conditions. The current NPDES permit "expired" in June, 1998, but remains in effect while EPA develops a new permit. EPA co-issues this permit with the Massachusetts DEP. EPA must also coordinate closely with Rhode Island because its waters are also affected by the plant. The permit must ensure that both Massachusetts and Rhode Island water quality standards are satisfied unless a variance authorizing excursions from those standards is granted. Similarly, both states' Coastal Zone Management Programs must be satisfied, along with the federal Essential Fish Habitat program and other federal requirements.

There has been a significant amount of controversy about the plant because of the documented collapse of fish populations in Mount Hope Bay and the debate over the power plant's role in causing or contributing to the fishery decline. On October 9, 1996, Rhode Island Department of Environmental Management issued a report which documented an alarming, sharp decline in abundance of finfish populations in Mount Hope Bay that appeared to occur about seventeen years ago with no subsequent recovery in evidence. Additional review of the data has suggested that the fishery decline actually began, albeit at a gentler pace, before the sharp decline evidenced around 1985. Adverse effects of plant cooling system operations on aquatic organisms can be divided into the following major categories: (1) cooling water intake *entrainment* of fish eggs and larvae and other small organisms into the plant's cooling system; (2) cooling water intake *impingement* of larger organisms on the intake screening systems; and (3) discharge-related effects from the impacts of the thermal effluent on the aquatic community and its habitat. Entrainment and thermal discharge appear to be especially significant issues for this plant, with impingement appearing to be a relatively less major problem.

In response to the developing controversy, federal and state regulatory agencies and former plant owner NEPCO entered into a Memorandum of Agreement (MOA) in April, 1997, regarding plant operations. The MOA places annual and seasonal caps on the level of heat discharged and the amount of cooling water withdrawn from the Bay. In the MOA the Company agreed to limit its operations to levels below that authorized by the (still) current NPDES permit and the agencies agreed not to push for an immediate modification of the permit. (NEPCO had threatened to appeal any immediate permit modification anyway.) The intake volume and thermal discharge caps in the MOA represented a compromise between the levels initially sought by the regulatory agencies and the levels the company claimed were justified. The MOA also indicated that a number of types of research should be pursued to help with development of a new NPDES permit. When PG&E bought Brayton Point Station it assumed responsibility for complying with the MOA (the MOA required that agreement to comply with the MOA be made a condition of any sale of the plant). Since the 1997 MOA, the permittee and the regulatory agencies have been engaged in extensive monitoring, modeling and study to determine the conditions for a new NPDES permit.

On October 2, 2001, PG&E publicly announced a proposed $250,000,000 environmental improvement plan for the facility including new air pollution controls, ash recycling facilities, and a new cooling water system using mechanical draft wet cooling tower that PG&E refers to as the Enhanced Multi-Mode System. The Company intends this plan to address requirements under the new State air quality regulations, a State Administrative Consent Order addressing ash management practices, and the new NPDES permit. PG&E states that this new system will reduce heat loadings into Mount Hope Bay, and reduce cooling water withdrawals from Mount Hope Bay, to pre-1984 levels. The year 1984 is significant because it was the year that Brayton Point was permitted to switch Unit 4 from a previously closed-cycle cooling system to a once-through cooling system, and some data suggests that the steep decline in fish populations was coincidental with this modification. (As noted above, there is also data suggesting that the decline had started earlier but accelerated after Unit 4 began once-through cooling operations.)

EPA is working closely with Massachusetts and Rhode Island on the permit, and has also been coordinating with the National Marine Fisheries Service. The permit will be jointly issued with the state in Massachusetts which does not have NPDES delegation. EPA is also in close communication with the company regarding the issues, and the company has submitted a substantial amount of information supporting its view of what limits should be in the new permit. EPA has also received significant communications from interested environmental groups. In addition, there has been congressional interest in both

Massachusetts and Rhode Island as well as statements of concern by the Governor of Rhode Island. Public interest in the permit development is high. Over the past year serious concerns have been raised by groups including Save the Bay, Conservation Law Foundation, the Rhode Island Salt Water Anglers, and the New England Fishery Management Council. Also, the Rhode Island Attorney General has also been actively engaged in tracking the matter and has publicly threatened to sue the company over damage to Rhode Island's natural resources. Finally, the permit issues have received substantial attention in local major media outlets, including a recent front page story in the Boston Globe.

Options considered by EPA differ considerably in their ability to reduce implementation differences between two or more states that share access to the same waterbody. The greater the level of benefits associated with a regulation, the lower the level of I&E losses that can occur in one state and affect the biology, environmental conditions, and benefits of another state. Thus the greater the benefits of a regulation, the fewer the "external costs" or damages that can be imposed by one state on other states.

A2-2.5 Reducing Transaction Costs

Transaction costs associated with the implementation of a regulation include: (1) determining the desired level of environmental quality and (2) determining how to achieve it.

Transaction costs associated with determining the desired level of environmental quality have to do with the supply and demand for environmental quality.

The presence of uncertainties increases transaction costs. Some uncertainties relate to the supply of environmental quality (e.g., the actual impact of various control technologies in terms of the effectiveness of I&E reductions); others relate to the demand for environmental quality (e.g., the value of reduced I&E in terms of individual and population impacts). Reducing uncertainties would reduce transaction costs. Standardizing the protocol for monitoring and reporting I&E impacts reduces the uncertainty about how to measure the impact of controls, and provides for a uniform "language" for communicating these impacts. A federal regulation that establishes methods for mitigating the impact of regulatory uncertainty and information uncertainty produces a benefit in the form of reduced (transaction) costs.

There is another set of uncertainties that is independent of the desired level of environmental quality. These uncertainties fall into the broad categories of "regulatory uncertainty" and "information uncertainty." The costs related to these uncertainties lead to "transaction costs," which cause inefficiencies in decision-making related to achieving a given level of environmental quality. *Regulatory uncertainty* refers to the uncertainty that facilities face when making business decisions in response to regulatory requirements when those requirements are uncertain. For example, facilities are making business decisions today based on their best guess about what future regulation will look like. The cost of this uncertainty comes in the form of delayed business decisions and poor business decisions based on incorrect guesses about the future regulation. *Information uncertainty* refers to the uncertainty related to the measurement and communication of the impact of controls on actual I&E, as well as the impact of I&E on populations. The consequence of information uncertainty is poor decision-making by stakeholders (suppliers and demanders of environmental quality) and a reduction in the cost-effectiveness of meeting a desired level of environmental quality.

Transaction costs are incurred at several levels, including the states and Tribes authorized to implement the NPDES program; the federal government; and facilities subject to section 316(b) regulation.

Section 316(b) requirements are implemented through NPDES permits. States and Tribes authorized to implement the NPDES program do so through the issuance of permits to power producing facilities. Forty-four states and the Virgin Islands are currently authorized pursuant to section 402(b) of the CWA to implement the NPDES program. In states not authorized to implement the NPDES program, EPA issues NPDES permits. Under the CWA, states are not required to become authorized to administer the NPDES program. Rather, such authorization is available to states if they operate their programs in a manner consistent with section 402(b) and applicable regulations. Generally, these provisions require that state NPDES programs include requirements that are as stringent as federal program requirements. States retain the ability to implement requirements that are broader in scope or more stringent than federal requirements (See section 510 of the CWA).

Each state's, Tribe's, or region's burden associated with permitting activities depends on their personnel's background, resources, and the number of regulated facilities under their authority. Developing a permit requires technical and clerical staff to gather, prepare, and review various documents and supporting materials, verify data sources, plan responses, determine specific permit requirements, write the actual permit, and confer with facilities and the interested public.

Where states and Tribal governments do not have NPDES permitting authority, the federal government implements section 316(b) regulations through its regional offices. The section 316(b) regulation is also necessary to reduce the burden on the regions.

Uncertainty about what constitutes AEI, and the BTA that would minimize AEI, also increases transaction costs to facilities. Without well-defined section 316(b) requirements, facilities have an incentive to delay or altogether avoid implementing I&E technologies by trying to show that their CWIS do not have impacts at certain levels of biological organization, e.g., population or community levels. Some facilities thus spend large amounts of time and money on studies and analyses without ever implementing technologies that would reduce I&E. Better definition of section 316(b) requirements could lead to a better use of these resources by investing them in I&E reduction rather than studies and analyses.

The options considered by EPA differ considerably in their ability to reduce transactions costs. The greater the site specific nature of the regulation the greater the transaction costs associated with the regulation. Options that are simpler, even though they may involve higher technology and operation and maintenance costs, are likely to have much lower transaction costs.

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